

(12) **UK Patent Application** (19) **GB** (11) **2 321 624** (13) **A**

(43) Date of A Publication 05.08.1998

(21) Application No 9701586.1

(22) Date of Filing 27.01.1997

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(51) INT CL<sup>6</sup>  
**B60R 21/34**

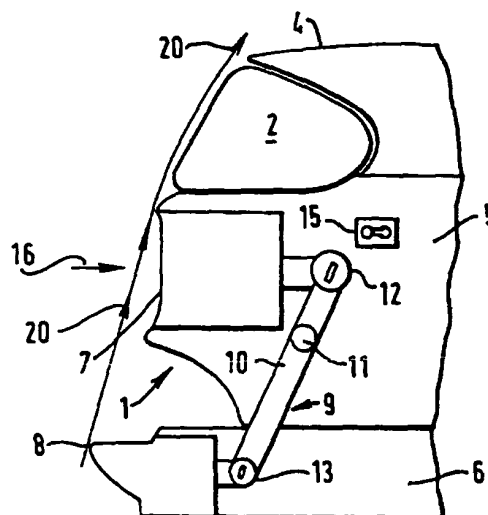
(52) UK CL (Edition P )  
**B7B BSBNC**

(56) Documents Cited  
**GB 2069940 A US 5016933 A US 4015870 A**

(58) Field of Search  
 UK CL (Edition O ) **B7B BSB BSEA BSEB BSEM BSES**  
 INT CL<sup>6</sup> **B60R 19/02 19/04 19/12 19/16 19/24 19/26**  
**19/38 21/00 21/34**

(54) Abstract Title  
**Bumper assembly with forwardly displaceable lower portion**

(57) A pedestrian injury reducing vehicle bumper assembly 1 has an upper fender part 5 with a front impact face 7 and a lower fender part 6 with a buffer 8. The parts 5 and 6 are displaceable relative to each other horizontally of the vehicle and are interconnected by a pivoted linkage 9, hydraulically or electrically so that in response to body impact on the face 7 to displace the fender part 5 rearwardly, there is forward displacement of the lower fender part 6. The bumper assembly then guides the impacted body along the line 20 to be thrown upwardly and rearwardly onto the bonnet 4. In a modification (Fig.8) the fender parts 5 and 6 are a unified structure which pivots as a whole.

**FIG. 4****GB 2 321 624 A**

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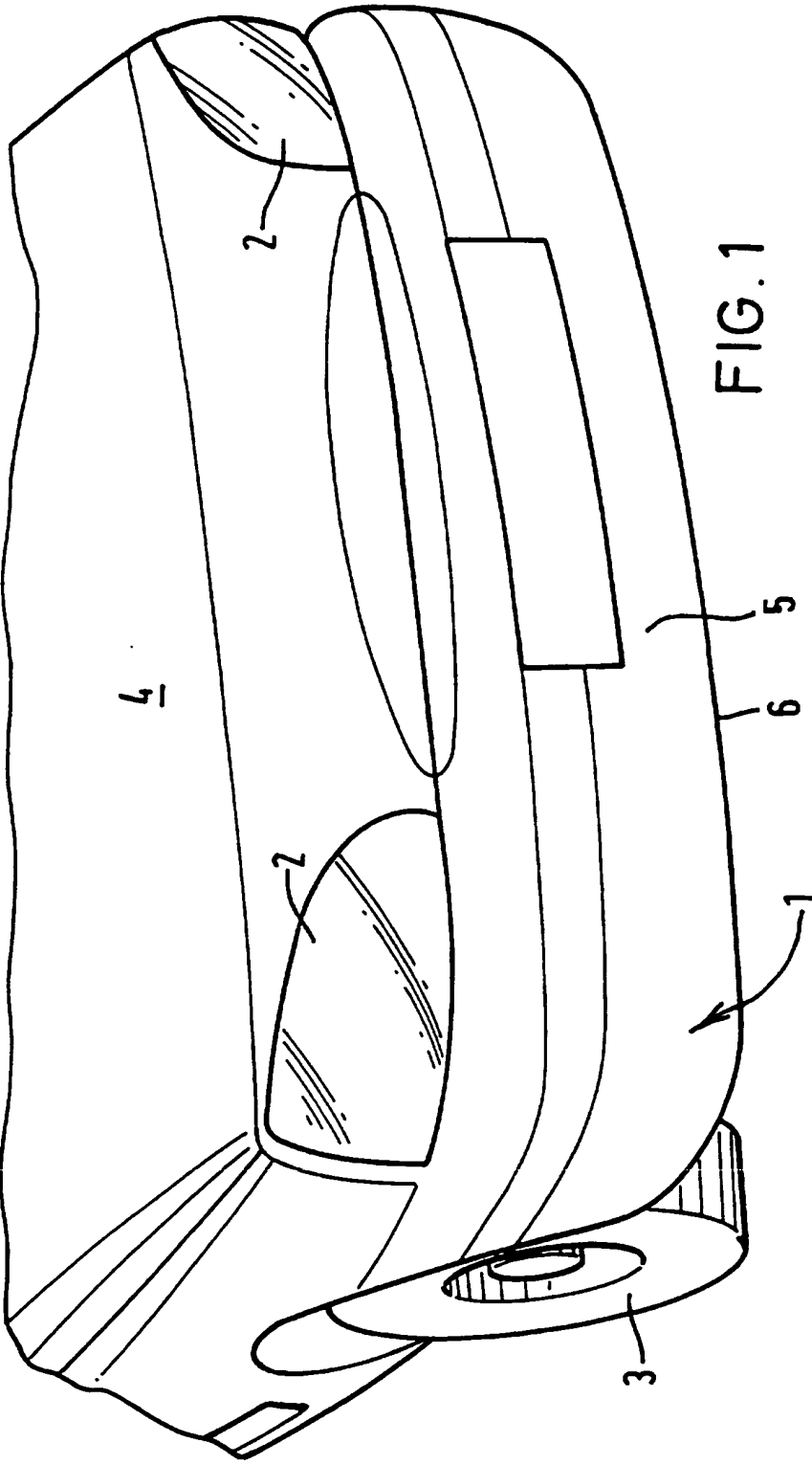


FIG. 1

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FIG. 2

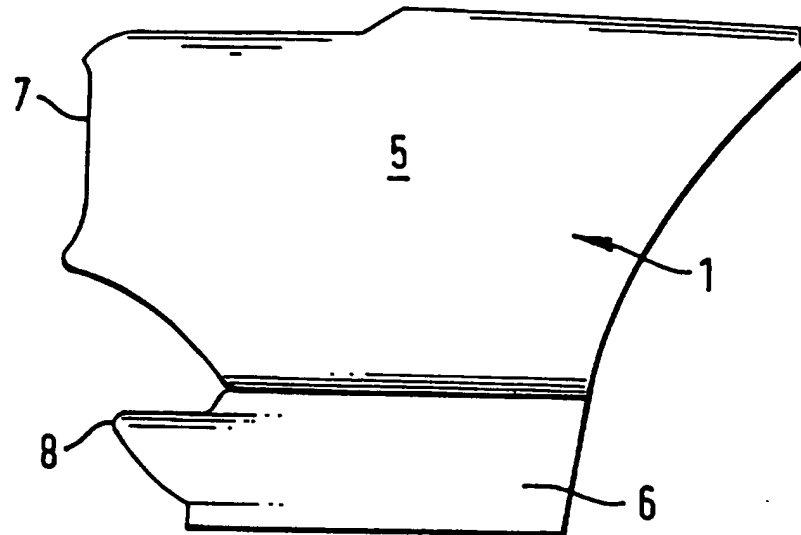
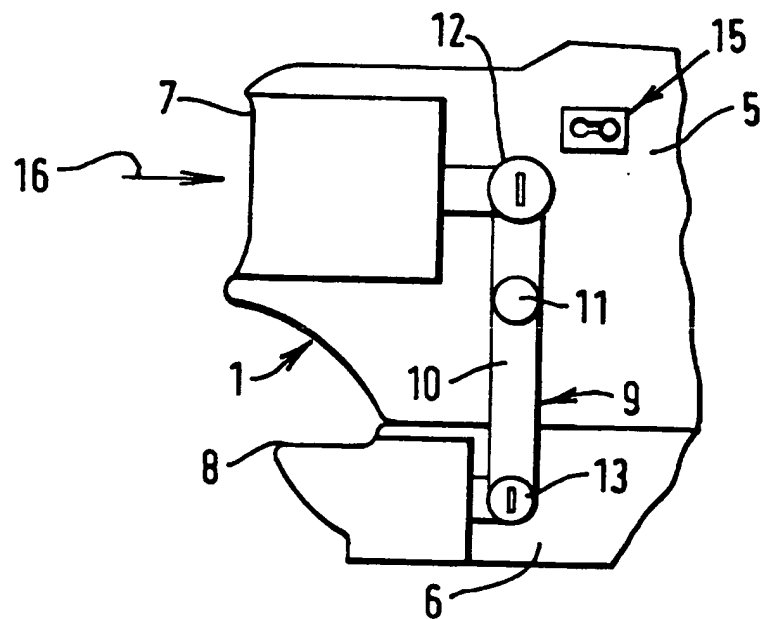


FIG. 3



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FIG. 4

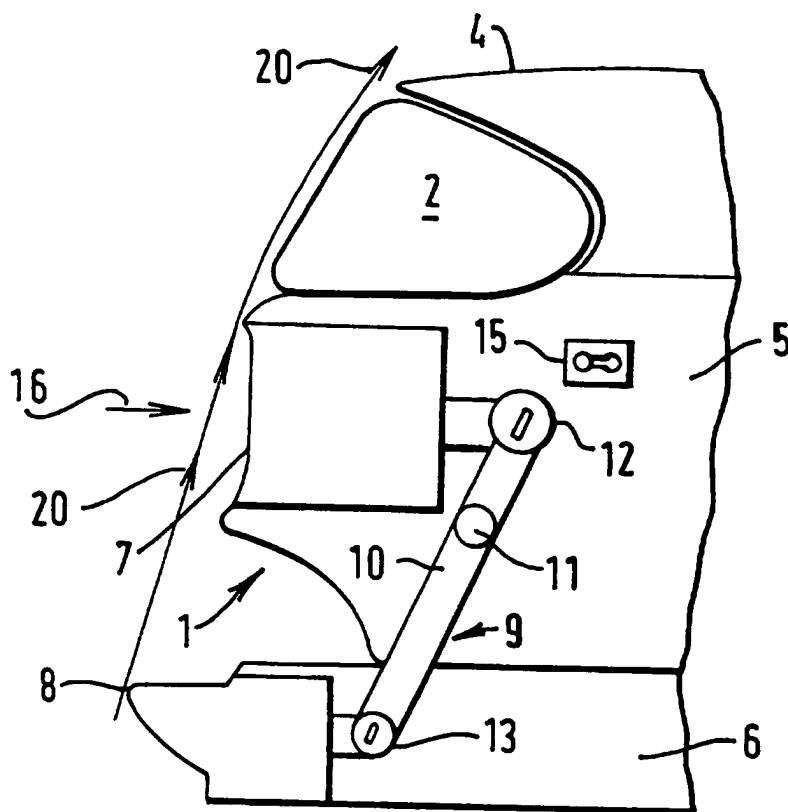
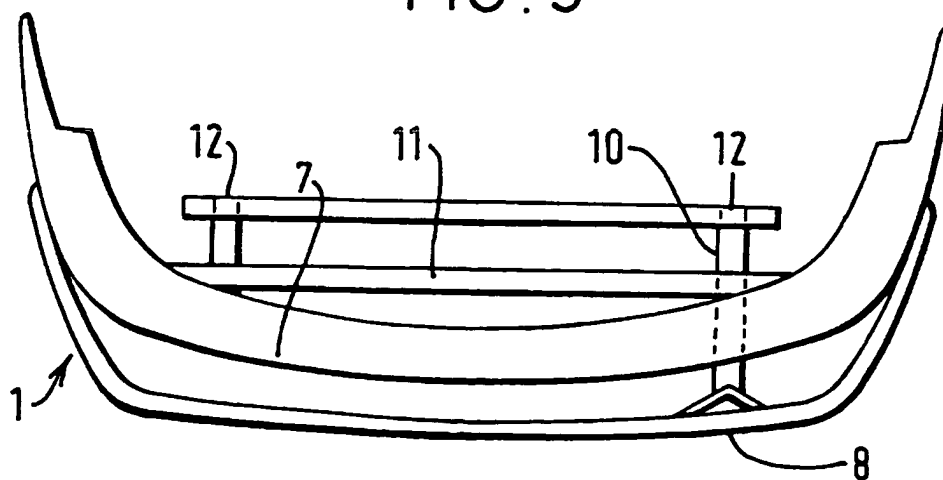


FIG. 5



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FIG. 6

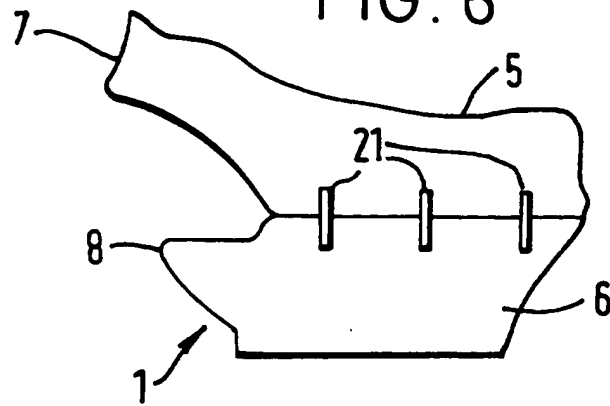
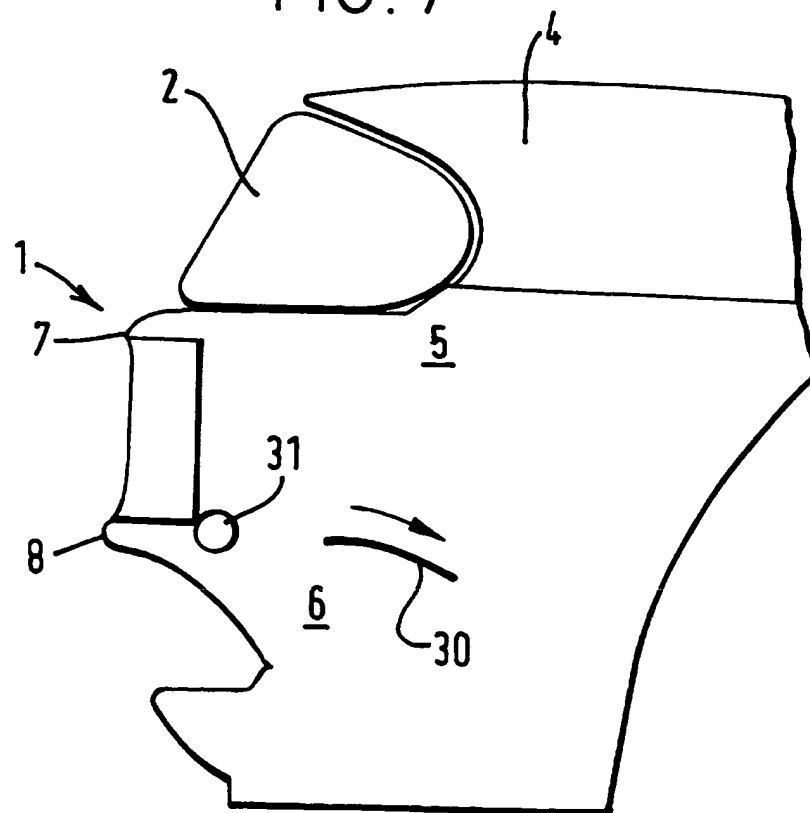


FIG. 7



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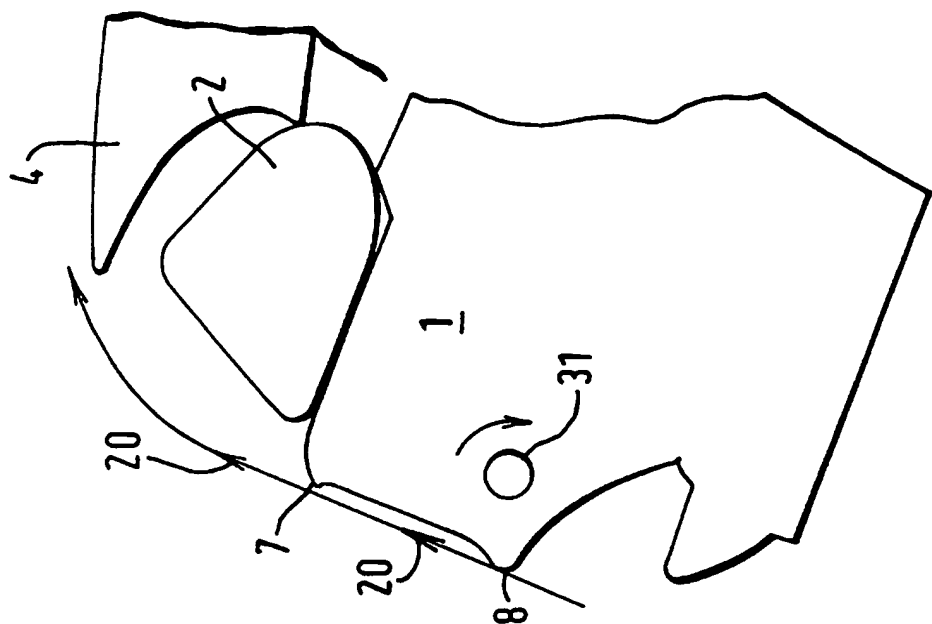


FIG. 9

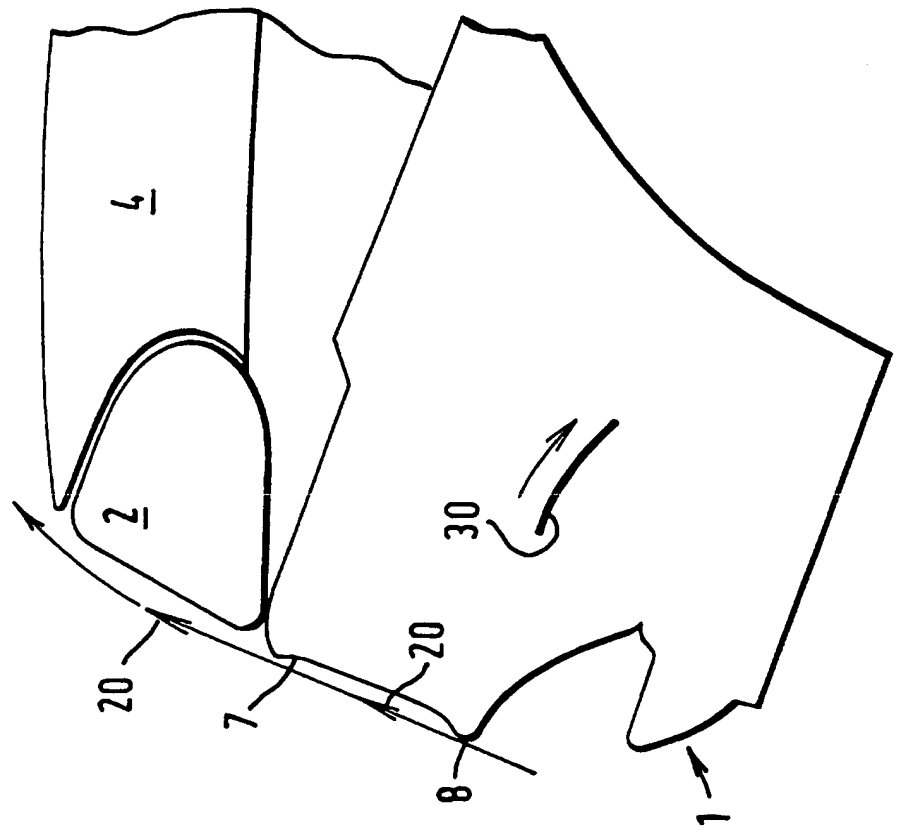


FIG. 8

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**TITLE****"Vehicle bumper assemblies"****TECHNICAL FIELD & BACKGROUND ART**

5 The present invention relates to a vehicle bumper assembly and a vehicle which includes such an assembly. The invention primarily concerns motor vehicles of the automobile type where the bumper assembly is, or is intended to be, fitted to the front of the vehicle.

10 Bumper assemblies are primarily intended to alleviate damage to a vehicle body in response to an impact and as such generally provide the leading part of the vehicle. As a consequence, in the event of a collision between the vehicle and a pedestrian it is usually the pedestrian's legs or lower body part which is first impacted by the bumper of the vehicle and even with modern relatively resilient plastics bumper assemblies and at low speeds, serious injury can be caused to the pedestrian, often resulting in the pedestrian being knocked to the ground beneath the bumper assembly of the moving vehicle. It is an object of the present invention to provide a vehicle bumper assembly and a vehicle which includes such an assembly and which may serve to alleviate the likelihood of injury to a pedestrian with which the bumper assembly of a moving vehicle may collide.

25 **STATEMENT OF INVENTION & ADVANTAGES**

According to the present invention there is provided a vehicle bumper assembly comprising an upper fender part having a forwardly directed impact face and a lower fender part having a forwardly directed buffer, said fender parts being displaceably mounted whereby in response to a rearwardly directed impact applied by a body on said forwardly directed face causing said upper fender part to be displaced rearwardly, said lower fender part is

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consequently displaced in a forward direction to an impact position in which the buffer is disposed forwardly of said impact face for the impact face and buffer to direct said body upwardly and rearwardly over the bumper assembly.

5       The invention also provides for a vehicle which includes a bumper assembly as specified in the immediately preceding paragraph.

10       It is inevitable that when a moving motor vehicle is in collision with a pedestrian, injury to the person may result. The majority of collisions between automobiles and pedestrians occur at the front of the vehicle and the intention of the bumper assembly of the present invention is that the impact of the pedestrian on the assembly results in the assembly adopting a condition by which it  
15       leads the pedestrian upwardly and rearwardly over itself during the relative movement between the vehicle and the pedestrian. Conventional automobiles have a hood or bonnet on to which pedestrians may be thrown following impact by the vehicle. It is believed that a pedestrian  
20       thrown on to the bonnet or hood of a vehicle as a result of a collision with that vehicle is likely to suffer less serious injury than a pedestrian over whom the vehicle passes following the collision - the bumper assembly of the present invention increases the likelihood that a  
25       pedestrian will be thrown up on to the bonnet or hood of the vehicle, thereby reducing the likelihood that the pedestrian will suffer serious injury.

30       Preferably the buffer of the lower fender part is disposed rearwardly of the impact face of the upper fender part in the normal condition of the bumper assembly (that is its condition prior to an impact). This should ensure that during a collision between the bumper assembly and a pedestrian, the pedestrian will first collide with the

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impact face of the upper fender part.

The lower fender part may be displaceably mounted relative to the upper fender part with the fender parts being interconnected by displacement means. The displacement means is intended to react in response to the impact on the upper fender part to cause consequential displacement of the lower fender part in a forward direction relative to the upper fender part to position the buffer forwardly of the impact face. The displacement means preferably comprises a mechanical linkage such as pivotted levers extending between the fender parts. The displacement means can also comprise hydraulic, pneumatic or electrical devices or systems such as fluid rams or bags reacting between the two fender parts or electrical solenoids causing displacement of the lower fender part in response to sensors detecting an impact on the upper fender part.

Where the upper and lower fender parts are displaceable relative to each other (and possibly relative to a chassis of the vehicle), restraining means may be provided between those parts to restrain the aforementioned relative displacement until an impact of a predetermined force on the forwardly directed impact face is exceeded. The restraining means is conveniently provided by tack or spot welds or other form of bonding or shear pins between the upper and lower fender parts and which means are intended to be sheared or broken when the aforementioned predetermined force is exceeded.

As an alternative to the upper and lower fender parts being displaceable relative to each other, these fender parts may provide a unified structure that is pivotally or otherwise displaceably mounted on the vehicle so that displacement of the unified structure (for example by

rotation of that structure about a pivotal mounting) in response to the impact on the impact face causes displacement of the upper fender part in a rearward direction and the required displacement of the lower fender part in a forward direction. Where the upper and lower fender parts present a unified structure and the bumper assembly is located at the front of a vehicle, it may be advantageous for lights on the front of the vehicle to be carried by the unified structure. Such front lights can then be displaced with the unified structure in response to an impact to ensure that they are unlikely to impede movement of a pedestrian upwardly and rearwardly over the bumper assembly and on to a bonnet or hood with which the vehicle may be provided.

#### DRAWINGS

Embodiments of a vehicle bumper assembly and a vehicle including such an assembly will now be described by way of example only, with reference to the accompanying illustrative drawings, in which:

Figure 1 is a perspective view showing part of the front end of an automobile to which the bumper assembly is fitted;

Figure 2 is a side end view of the bumper assembly on the vehicle of Figure 1;

Figure 3 is a view similar to that shown in Figure 2 and diagrammatically illustrates a first embodiment of the bumper assembly prior to an impact;

Figure 4 shows the bumper assembly of Figure 3 following an impact;

Figure 5 is a plan view of the assembly shown in Figure 4;

Figure 6 shows a modification of the assembly in Figure 3 in which restraining means is provided to restrain

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relative displacement between upper and lower fender parts of the assembly;

5        Figure 7 diagrammatically illustrates a second embodiment of bumper assembly in side view similar to that shown in Figure 3 (including a front part of the vehicle) and prior to an impact;

10        Figure 8 is a similar view of the assembly to that shown in Figure 7 and diagrammatically illustrates displacement of the bumper assembly in response to an impact, and

Figure 9 shows a modification of the arrangement shown in Figure 8.

#### DETAILED DESCRIPTION OF DRAWINGS

15        The vehicle to which the bumper assembly 1 is fitted and the front end of which is shown in Figure 1, is a conventional automobile having front headlights 2, ground engaging wheels 3 and a hood or bonnet 4.

20        The front bumper assembly 1 is of the kind known as "wrap-around" in that it extends across the front of the vehicle and part way along front side wings of the vehicle and comprises an upper fender part 5 and a lower fender part 6. The upper fender part 5 has a forwardly directed impact face 7 and the lower part 6 has a forwardly directed buffer 8.

25        In the embodiment shown in Figures 3 to 5 the upper and lower fender parts 5 and 6 are separate components which are capable of being displaced horizontally and in a fore/aft direction of the vehicle relative to each other and to a chassis or frame of the vehicle. The fender parts 5 and 6 are interconnected by a mechanical linkage 9 comprising a lever 10 which is pivotally mounted on a bar of the vehicle chassis 11 to extend between the upper fender part 5 and the lower fender part 6 to which it is

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pivotally connected through lost motion linkages 12 and 13 respectively. The upper fender part 7 is carried on the vehicle chassis by slide pins indicated at 15 (Figure 3) which permit the upper fender part 5 to be displaced horizontally relative to the chassis and to the chassis bar 11 whilst the lower fender part 6 is carried by the upper fender part 5.

Upon an impact being applied in the direction of arrow 16 (Figure 3) against the forwardly directed impact face 7 with sufficient force to cause the upper fender part 5 to be displaced rearwardly and horizontally relative to the vehicle chassis and bar 11 (by sliding over the slide pins 15), the lever 10 is caused to pivot about the chassis bar 11 in a clockwise direction as shown in Figure 3. As a consequence the lower fender part 6 is displaced forwardly of the vehicle whilst sliding horizontally relative to the upper fender part 5.

It will be seen from Figure 3 that initially (in its normal condition) the bumper assembly 1 has its buffer 8 located slightly rearwardly of its impact face 7 so that the impact face 7 is likely to first encounter a pedestrian or other body that is struck by the bumper assembly of the vehicle when moving forwardly. However, following the displacement of the fender parts 5 and 6 as a result of an impact, the buffer 8 is displaced to be positioned forwardly of the impact face 7 as shown in Figure 4. The relative displacement that is provided between the upper and lower fender parts 5 and 6 is determined by the mechanical advantage afforded by the lever system 9 whilst the lost motion pivotal links 12 and 13 permit a parallel relationship to be maintained during relative horizontal movement between the upper and lower fender parts 5 and 6. Usually the fender part 6 will run on tracks or rails (not

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shown) on the fender part 5 during relative horizontal displacement between those parts and these rails and runners conveniently serve to carry and retain the lower frame part beneath the upper frame part.

5           From Figure 4 it will be seen that as the lower fender part 6 is moving forwardly of the vehicle following a body impacting the face 7, it is possible for the buffer 8 to engage the body (such as a pedestrian) which has impacted the bumper assembly 1. As a consequence of the body  
10 impact the buffer 8 is displaced to lead the impact face 7 so that there may be imparted to the body an upwardly and rearwardly directed force which causes it to move in the direction generally indicated by the line 20 (Figure 4) and onto the bonnet or hood 4 of the vehicle. In effect  
15 therefore a guide is presented by the bumper assembly along the line 20 to direct a pedestrian that is impacted by the bumper assembly upwardly onto the bonnet of the forwardly moving vehicle where, it is believed, the pedestrian is likely to suffer less injury than by being knocked down and  
20 run over by the vehicle.

          Although in Figure 4 the upper and lower fender parts are slidably displaceable relative to each other and to the chassis part 11 of the vehicle, it is preferred that this movement is damped or restrained so that it is initiated  
25 only when the load 16 exceeds a predetermined force. This restraint is conveniently provided by shear pins or very light spot welds indicated at 21 in Figure 6 which extend between the upper and lower fender parts 5 and 6. These pins or welds are intended to break to permit the required  
30 displacement of the fender parts in response to a predetermined impact force on the face 7.

Conveniently the upper and lower fender parts 5 and 6 are plastics mouldings.

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In the second embodiment shown in Figure 7 the bumper assembly is similar in shape to that shown in Figure 3 and has upper and lower fender parts 5 and 6 but in this second embodiment the fender parts are unified, conveniently being formed as a single plastics moulding to present the impact face 7 and the buffer 8 which is located below that impact face and substantially in vertical alignment therewith. The one piece bumper having the two fender parts is mounted on the chassis of the vehicle to be capable of displacement along an arcuate track indicated at 30 in Figure 7 in response to an impact on the leading impact face 7. Upon an impact being applied to the leading face 7 and displacement of the unified structure of the fender parts 5 and 6 along the track 30, that unified structure is effectively turned to the position shown in Figure 8 whereby the impact face 7 is displaced rearwardly of the forwardly moving vehicle so that the buffer 8 is presented forwardly of the impact face 7. Consequently the bumper assembly again provides guidance along the line 20 (Figure 8) to a pedestrian (or other body) impacted for the pedestrian to move upwardly and rearwardly over the bumper assembly 1 onto the hood 4.

In the design of vehicle shown in Figure 1 the headlights 2 are located adjacent to and above the bumper assembly 1. In the previously described embodiments and modifications the headlights 2 are components separate from the bumper assembly so that the fender parts move relative to the headlights 2. However, in the second embodiment shown in Figure 7 the headlights 2 may be carried by the upper fender part 5 to be included in the integral structure of the bumper assembly. This is particularly convenient as it permits the unified structure of the bumper assembly to rotate about a pivot 31 on the chassis

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(see Figures 7 and 9) rather than to slide along the track 30. Upon the impact face 7 colliding with a pedestrian, the unified structure of the bumper assembly (including the lights 2) rotates about the pivot 31 as shown in Figure 9 to a position in which it presents guidance along the line 20 for the pedestrian to be directed upwardly and over the bumper assembly onto the bonnet 4. With the bumper assembly in its pivotted position following impact as shown in Figure 9 it will be seen that the headlights 2 move out of their seatings in the vehicle body structure to ensure that those lights do not impede movement of the impacted body along the line 20 onto the vehicle bonnet.

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CLAIMS

1. A vehicle bumper assembly comprising an upper fender part having a forwardly directed impact face and a lower fender part having a forwardly directed buffer, said fender parts being displaceably mounted whereby in response to a rearwardly directed impact applied by a body on said forwardly directed face causing said upper fender part to be displaced rearwardly, said lower fender part is consequently displaced in a forward direction to an impact position in which the buffer is disposed forwardly of said impact face for the impact face and buffer to direct said body upwardly and rearwardly over the bumper assembly.
2. An assembly as claimed in claim 1 in which the buffer of the lower fender part is disposed rearwardly of the impact face prior to said impact.
3. An assembly as claimed in either claim 1 or claim 2 in which the lower fender part is displaceably mounted relative to the upper fender part, said fender parts being interconnected by displacement means which reacts in response to said impact to cause consequential displacement of the lower fender part in a forward direction relative to the upper fender part.
4. An assembly as claimed in claim 3 in which the displacement means is at least one of a mechanical linkage or an hydraulic, pneumatic or electrical device or system.
5. An assembly as claimed in either claim 3 or claim 4 in which restraining means is provided between the relatively displaceable fender parts to restrain displacement of the lower fender part relative to the upper fender part until an impact of a predetermined force applied to the forwardly directed impact face is exceeded.
6. An assembly as claimed in claim 5 in which the restraining means comprises tack welds, bonds or shear pins

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between the fender parts which are intended to be sheared or broken when the said predetermined force is exceeded.

5 7. An assembly as claimed in any one of claims 3 to 6 in which during said relative displacement between the lower fender part and the upper fender part, said parts are maintained in substantially parallel relationship.

8. An assembly as claimed in claim 7 in which the lower fender part is carried beneath the upper fender part by rails and runners which co-operate between those parts and permit the required relative displacement.

9. An assembly as claimed in either claim 1 or claim 2 in which the upper and lower fender parts provide a unified structure which structure is displaceably mounted so that its displacement in response to the impact on the impact face causes displacement of the upper fender part in a rearward direction to position the buffer of the lower fender part forwardly of the impact face.

10. An assembly as claimed in claim 9 in which the unified structure is pivotally mounted so that rotation of that structure about its pivot effects in displacement of the upper and lower fender parts.

11. A vehicle bumper assembly substantially as herein described with reference to the accompanying illustrative drawings.

12. A vehicle which includes a bumper assembly as claimed in any one of the preceding claims.

13. A vehicle as claimed in claim 12 in which the bumper assembly is located at a front end of the vehicle.

14. A vehicle as claimed in claim 13 and having a bonnet or hood and in said impact position the body is directed by the bumper assembly upwardly and rearwardly over the bumper assembly and onto the bonnet or hood.

15. A vehicle as claimed in either claim 13 or claim 14

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when appendant to claim 9 and having front lights carried by the unified structure of the upper and lower fender parts for said lights to be displaceable with that structure in response to said impact.

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The  
Patent  
Office

- 13 -

Application No: GB 9701586.1  
Claims searched: 1-15

Examiner: J. C. Barnes-Paddock  
Date of search: 27 March 1997

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): B7B (BSB BSEA BSEB BSEM BSES)

Int Cl (Ed.6): B60R 19/02,04,12, 16, 18, 24, 26, 38, 21/00, 34, 44, 46

Other:

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2,069,940 A (DAIMLER-BENZ) Fig. 1, page 1, lines 102-119. A fixed lower protective part.	
A	US 5,016,933 (SMIT) Fig. 2 A bumper in which the upper part moves towards the impact when the lower part is struck.	
A	US 4,015,870 (RENAULT/PEUGEOT) A pedestrian deflector with a hinged upper part	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.